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Primary Examiner — Sebastiano Passaniti

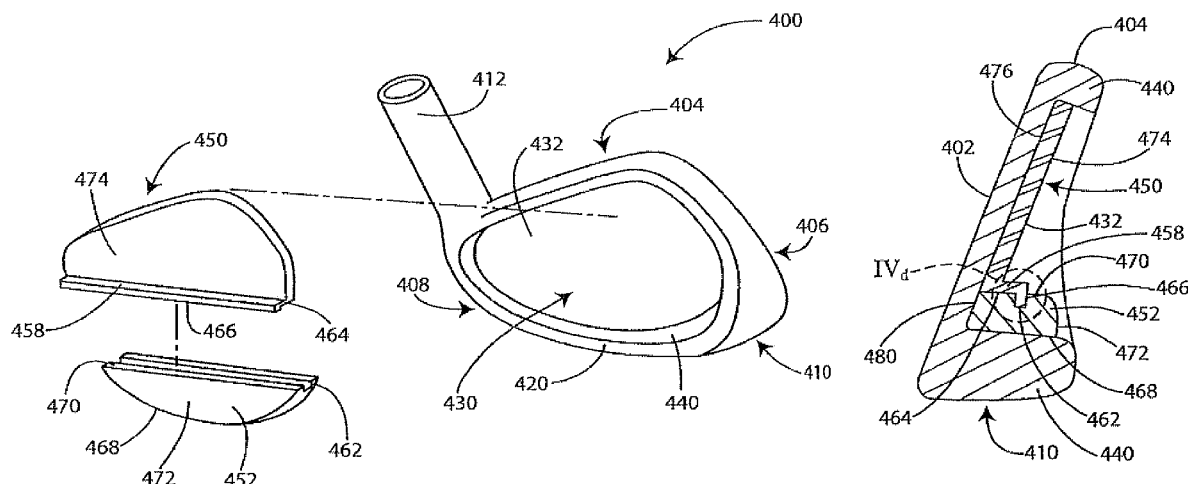
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(57) **ABSTRACT**

A golf club head according to one or more aspects of the present invention may include a strike face, a rear wall behind the strike face, and a perimeter-weighting element at least partially surrounding the rear wall. The club head may further include a preload spacer associated with the rear wall and a resilient component associated with the perimeter-weighting element. The preload spacer engages the resilient component to provide positive reinforcement of the coupling between the resilient component and the perimeter-weighting element.

18 Claims, 18 Drawing Sheets

(58) **Field of Classification Search**
CPC A63B 53/047; A63B 59/0092; A63B
2053/0491; A63B 2209/00; A63B 2053/0416



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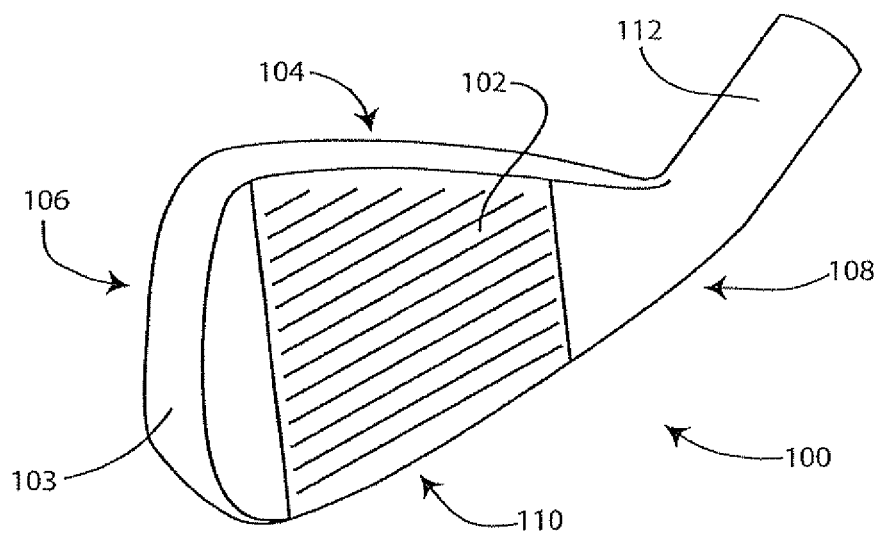


FIG. 1a

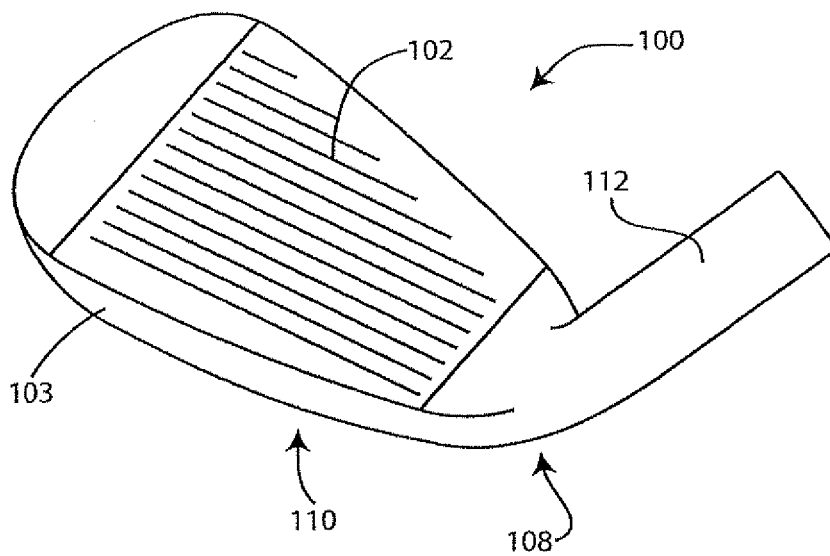


FIG. 1b

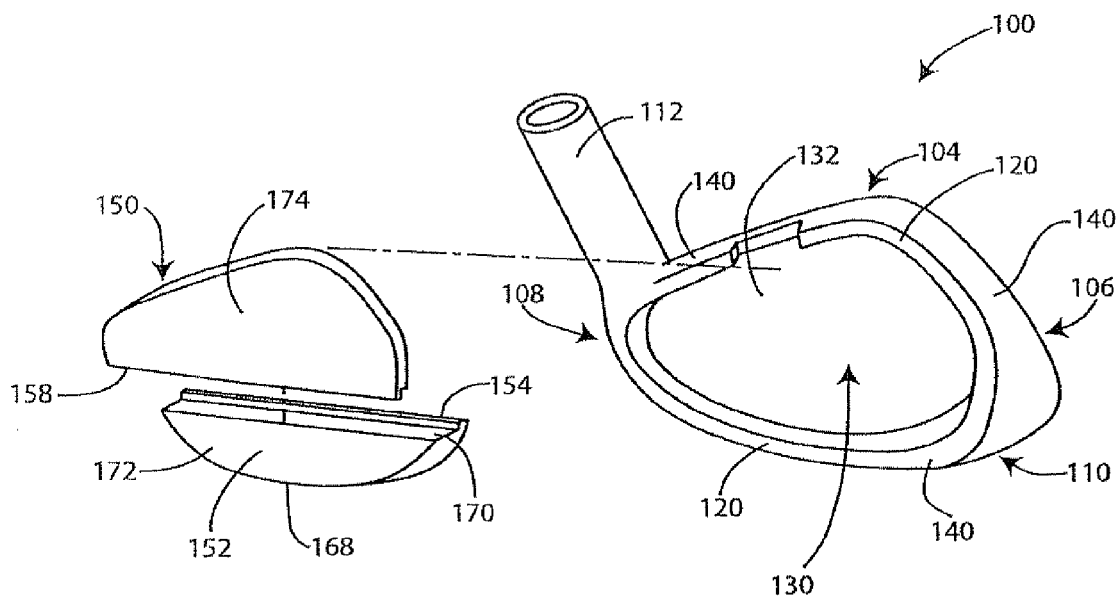


FIG. 1c

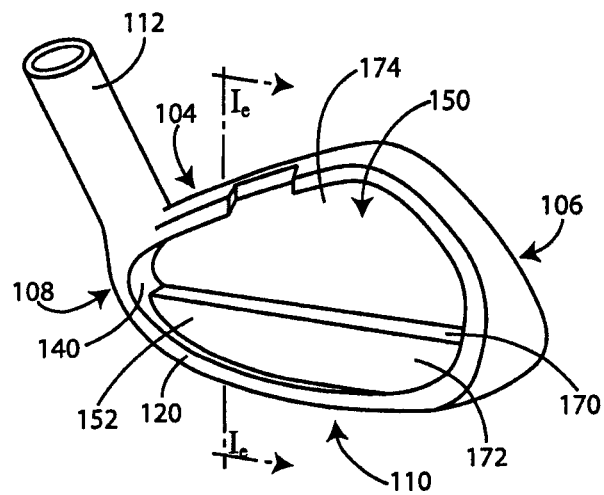
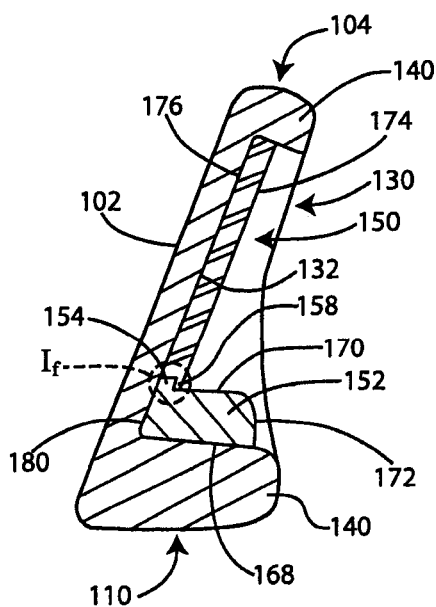


FIG. 1d



Front-to-Back Direction →

FIG. 1e

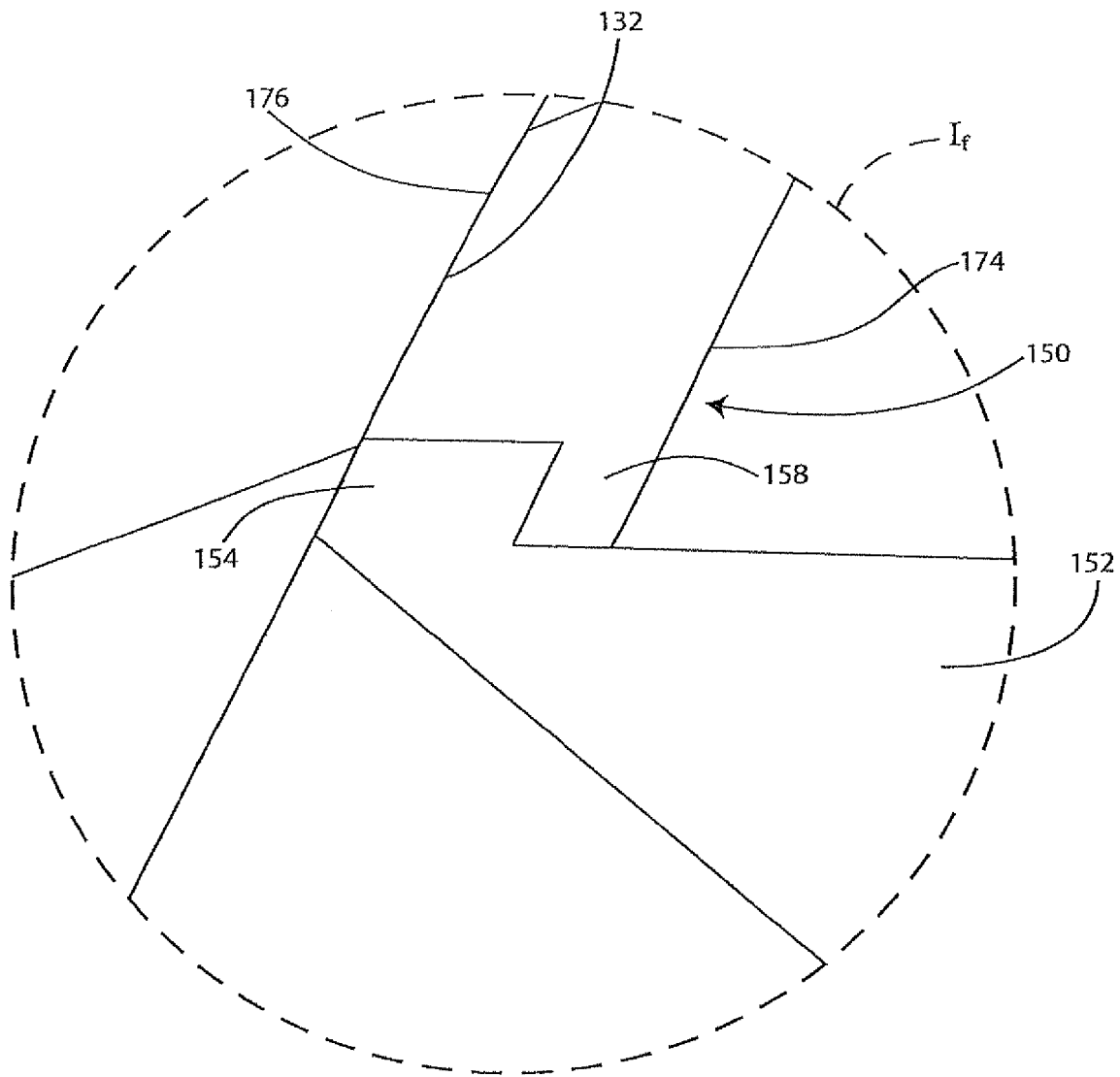


FIG. 1f

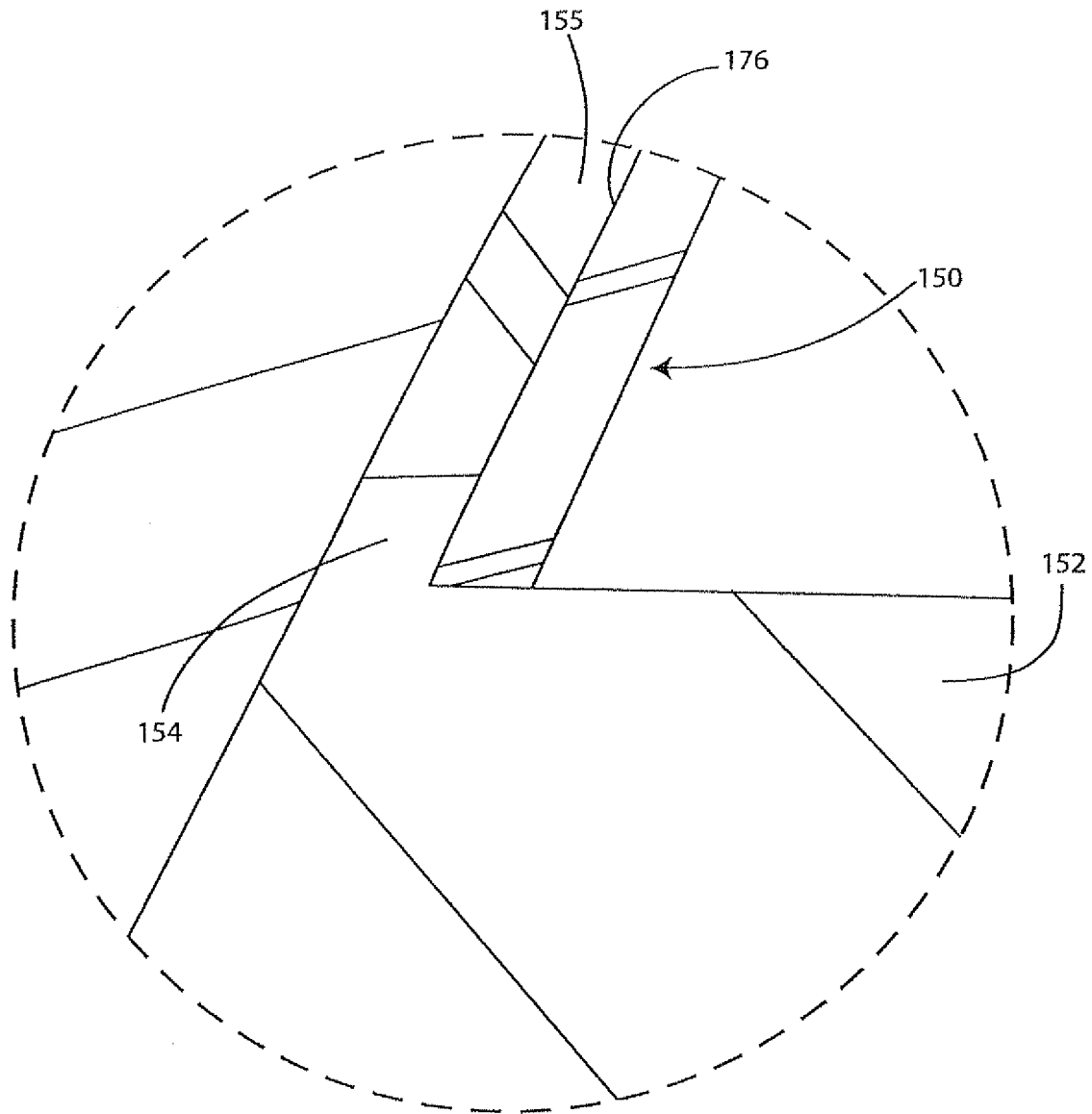


FIG. 1g

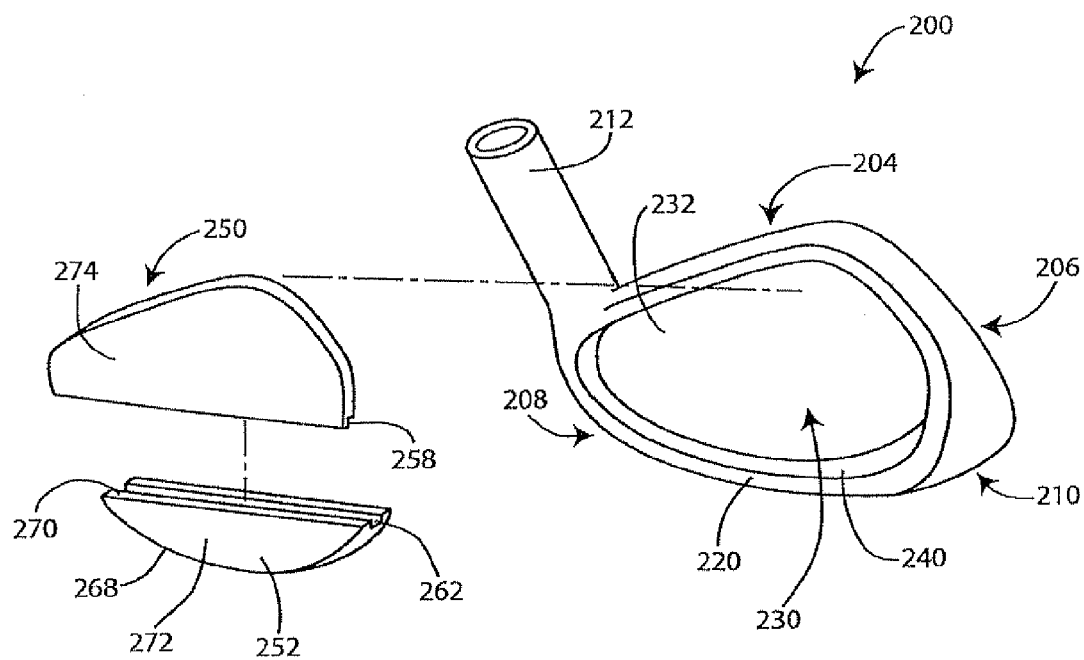


FIG. 2a

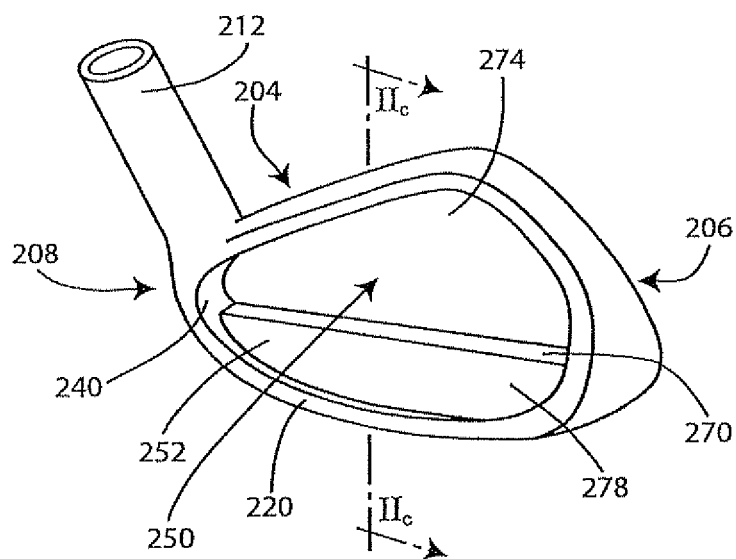


FIG. 2b

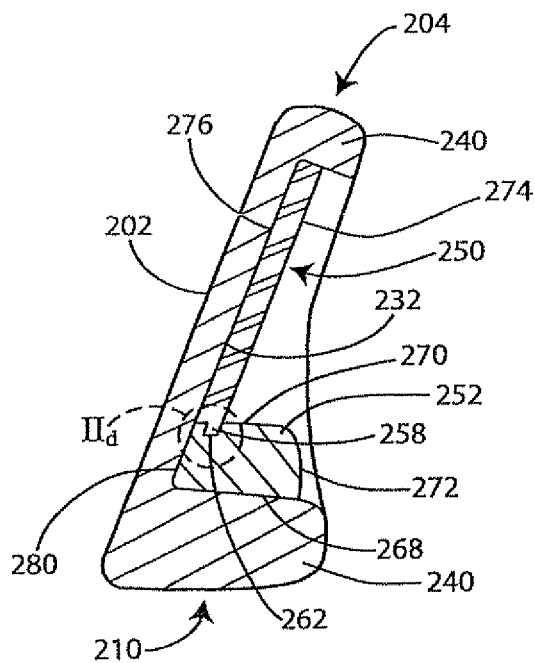


FIG. 2c

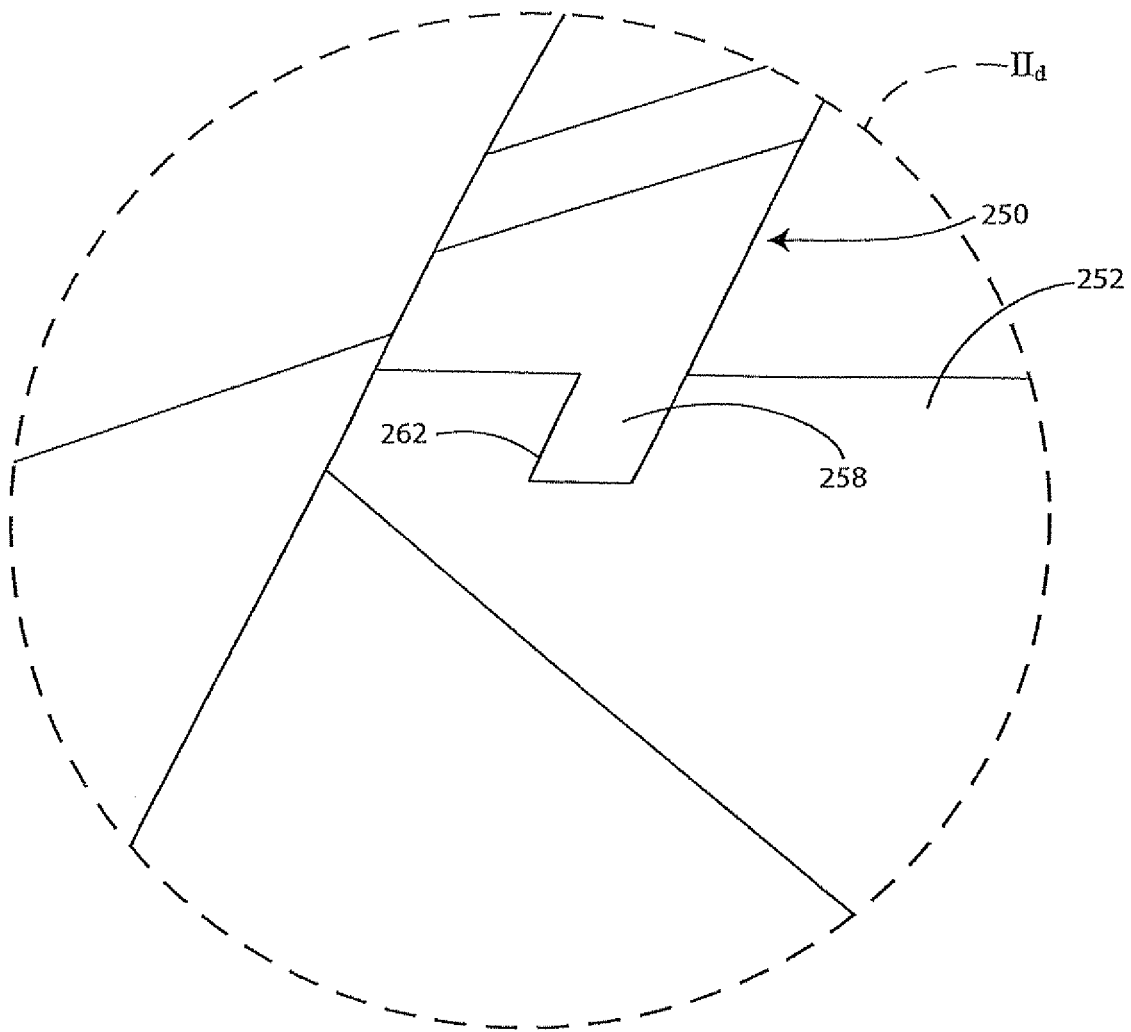


FIG. 2d

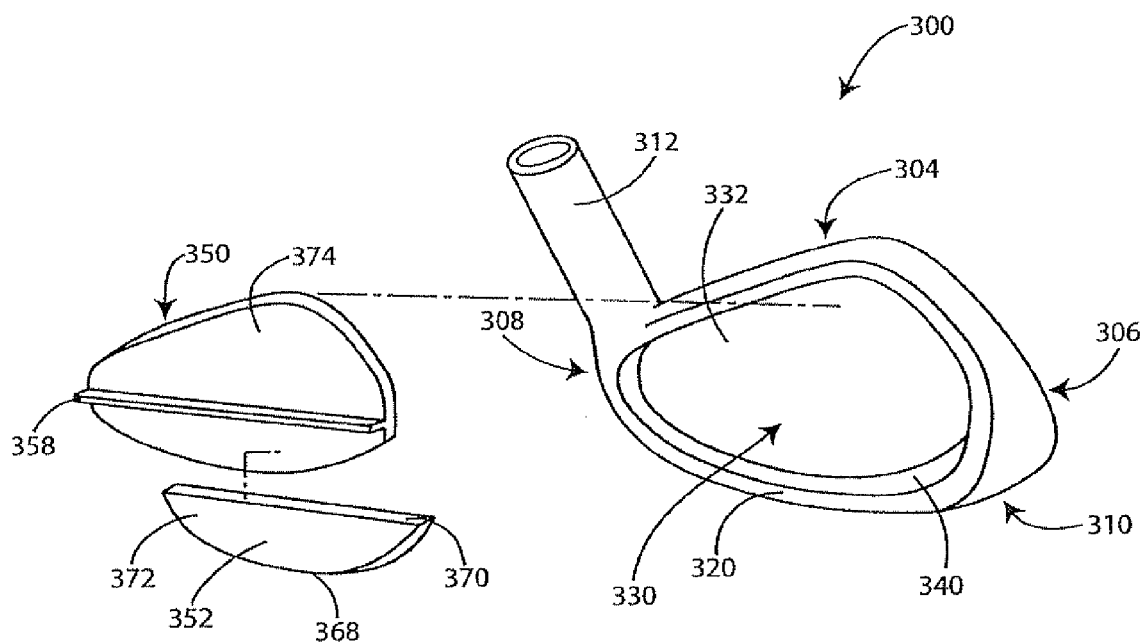


FIG. 3a

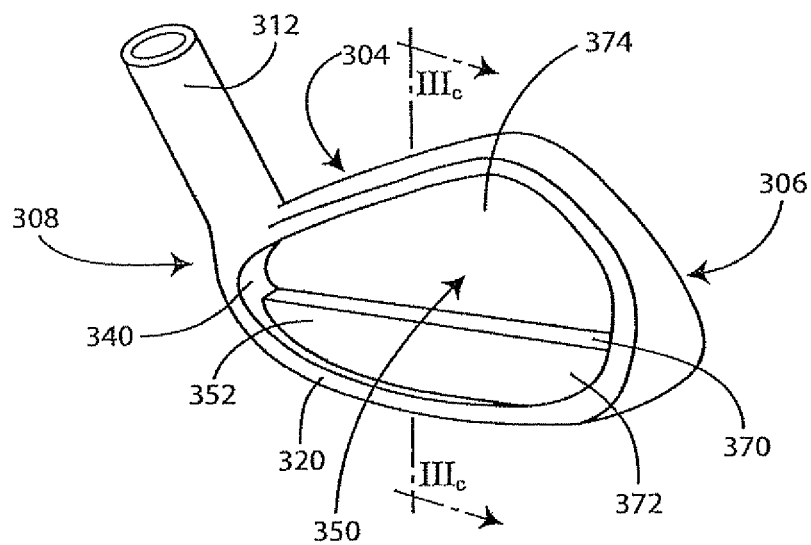


FIG. 3b

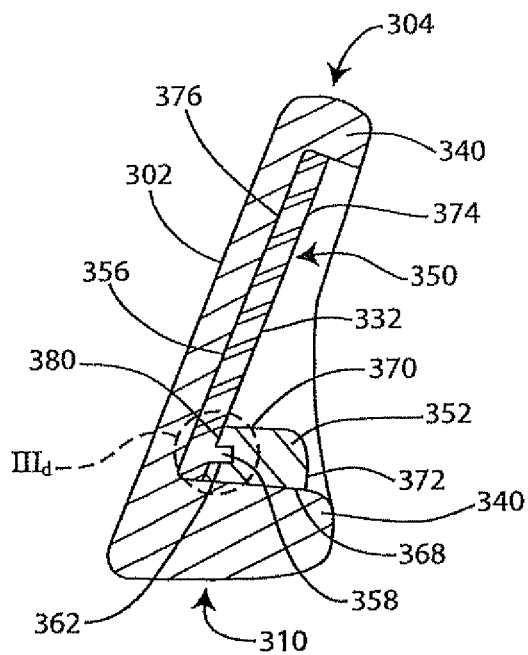


FIG. 3c

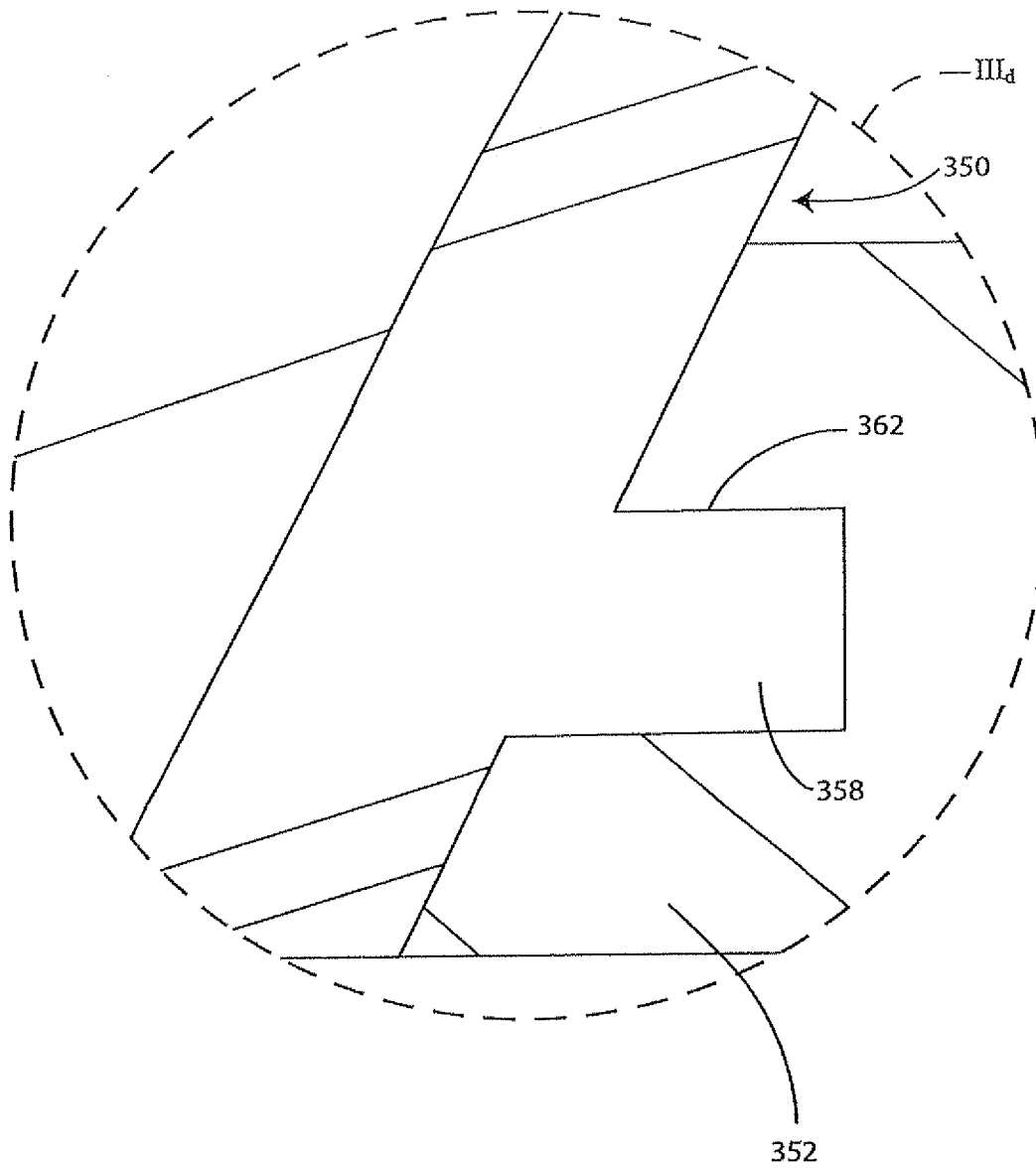


FIG. 3d

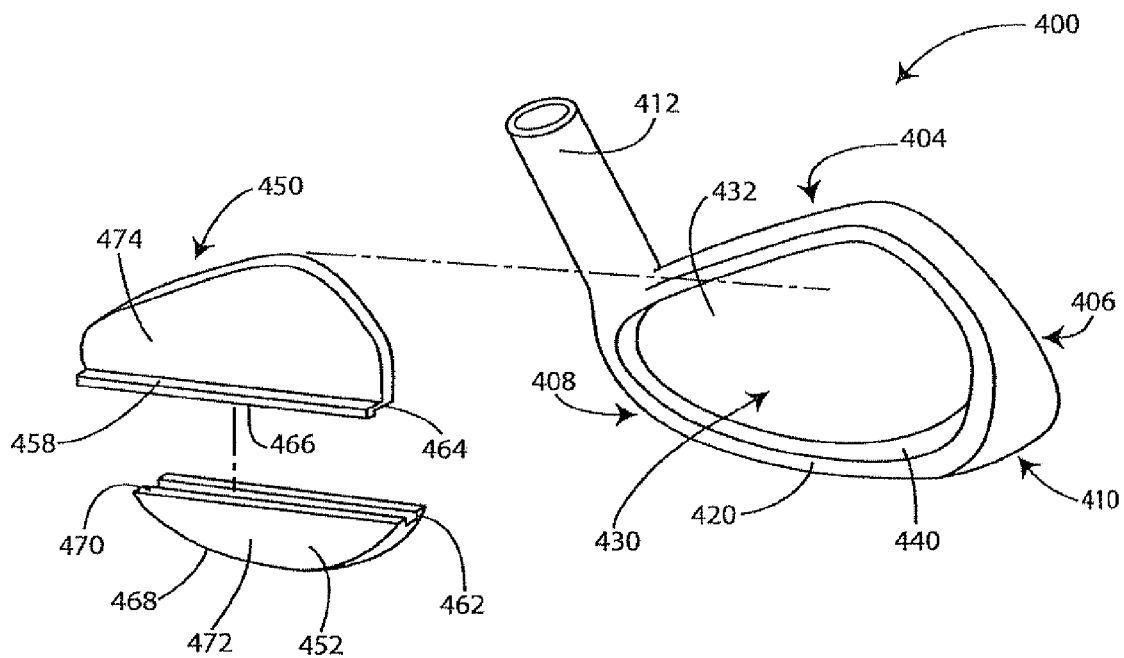


FIG. 4a

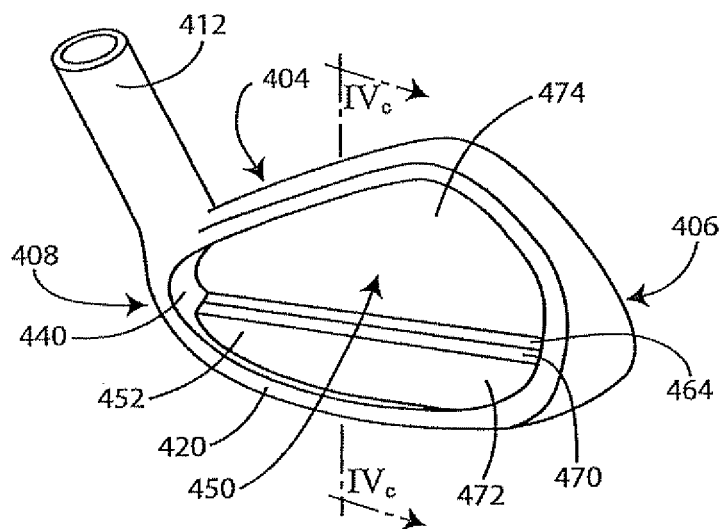


FIG. 4b

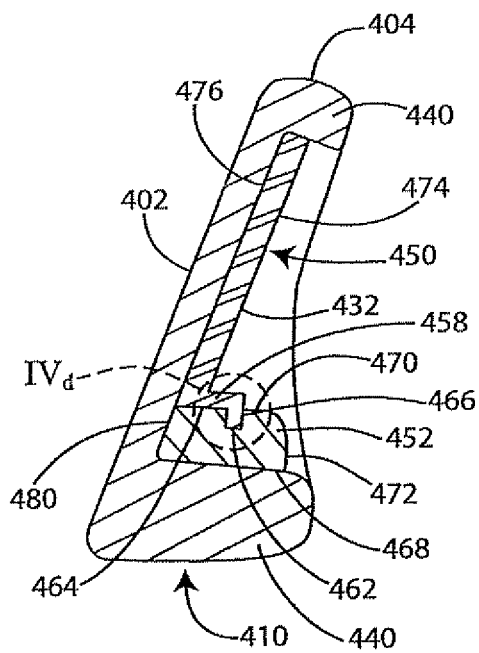


FIG. 4c

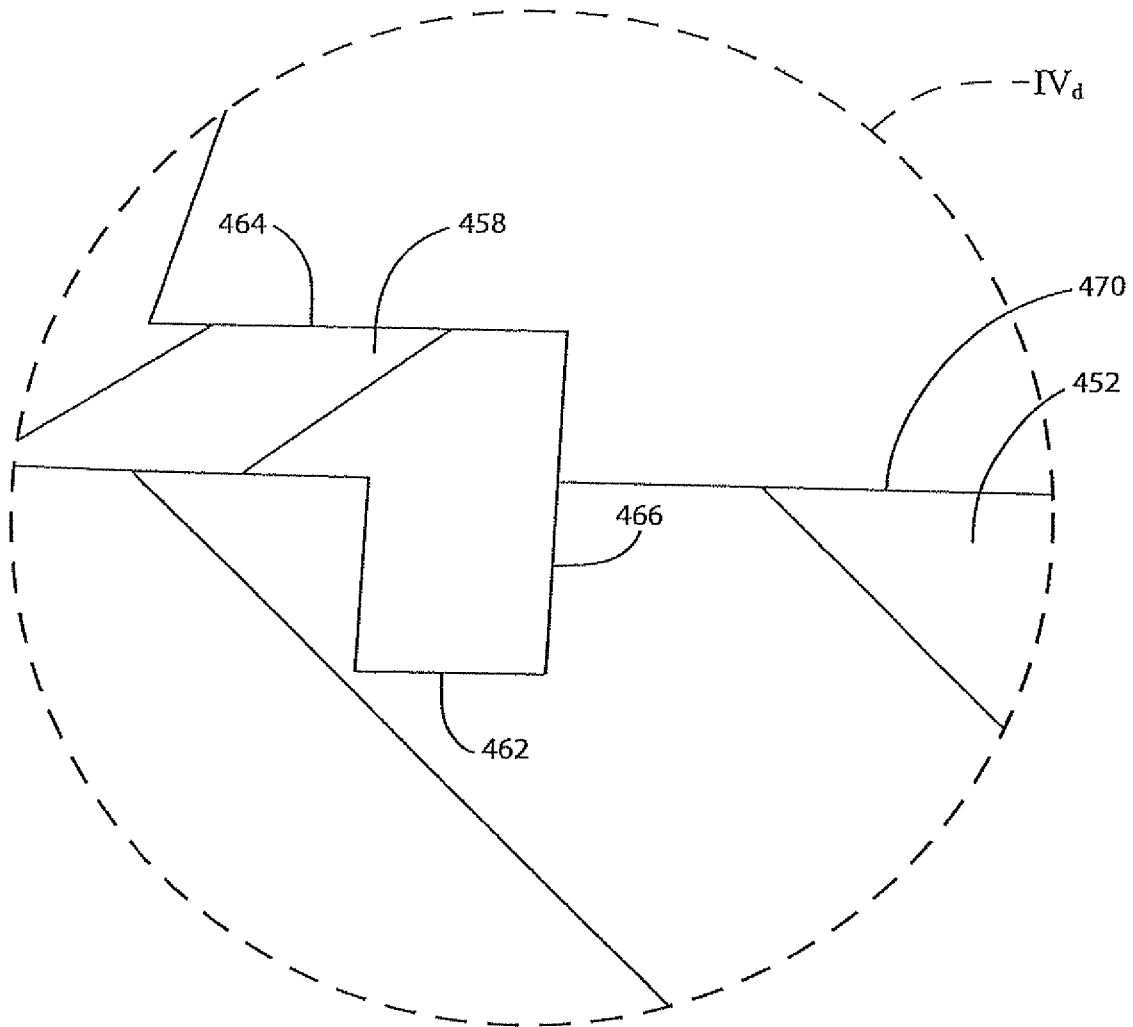


FIG. 4d

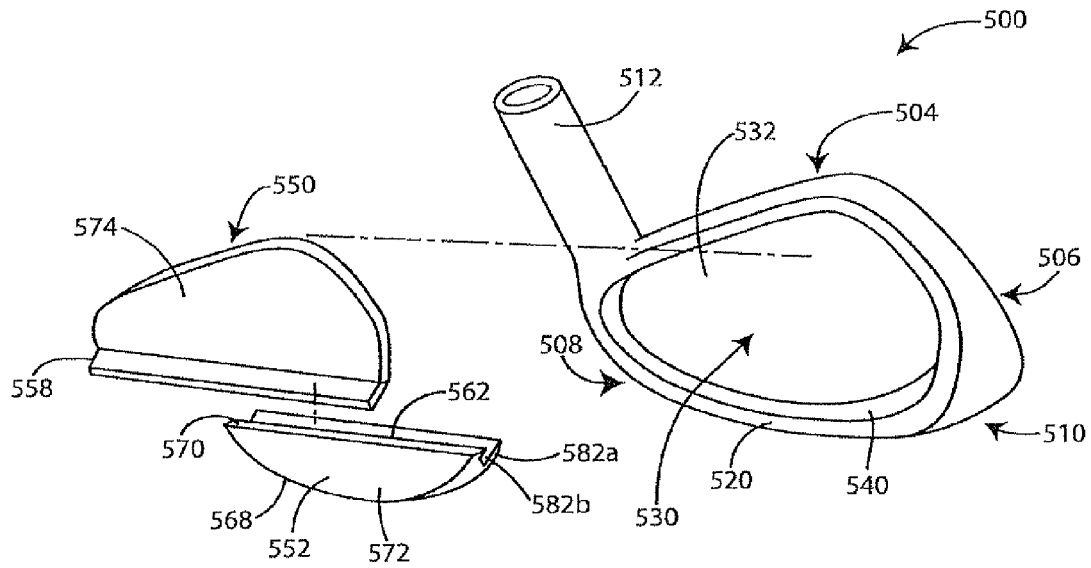


FIG. 5a

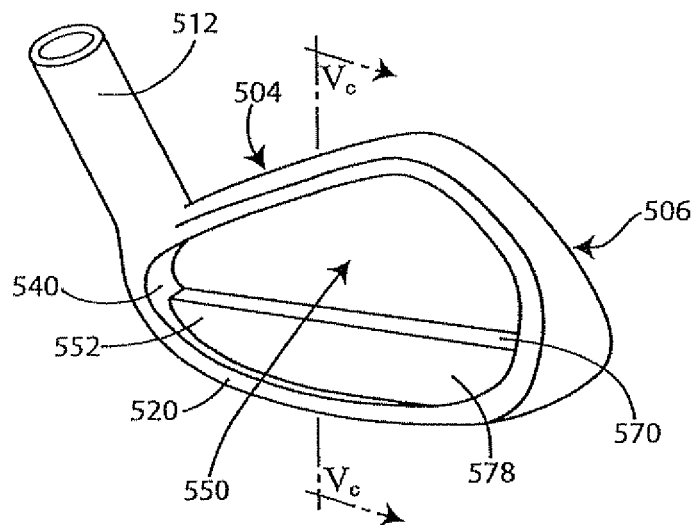


FIG. 5b

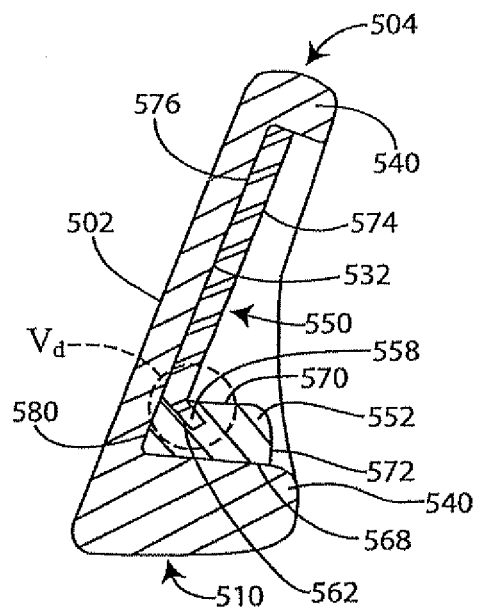


FIG. 5c

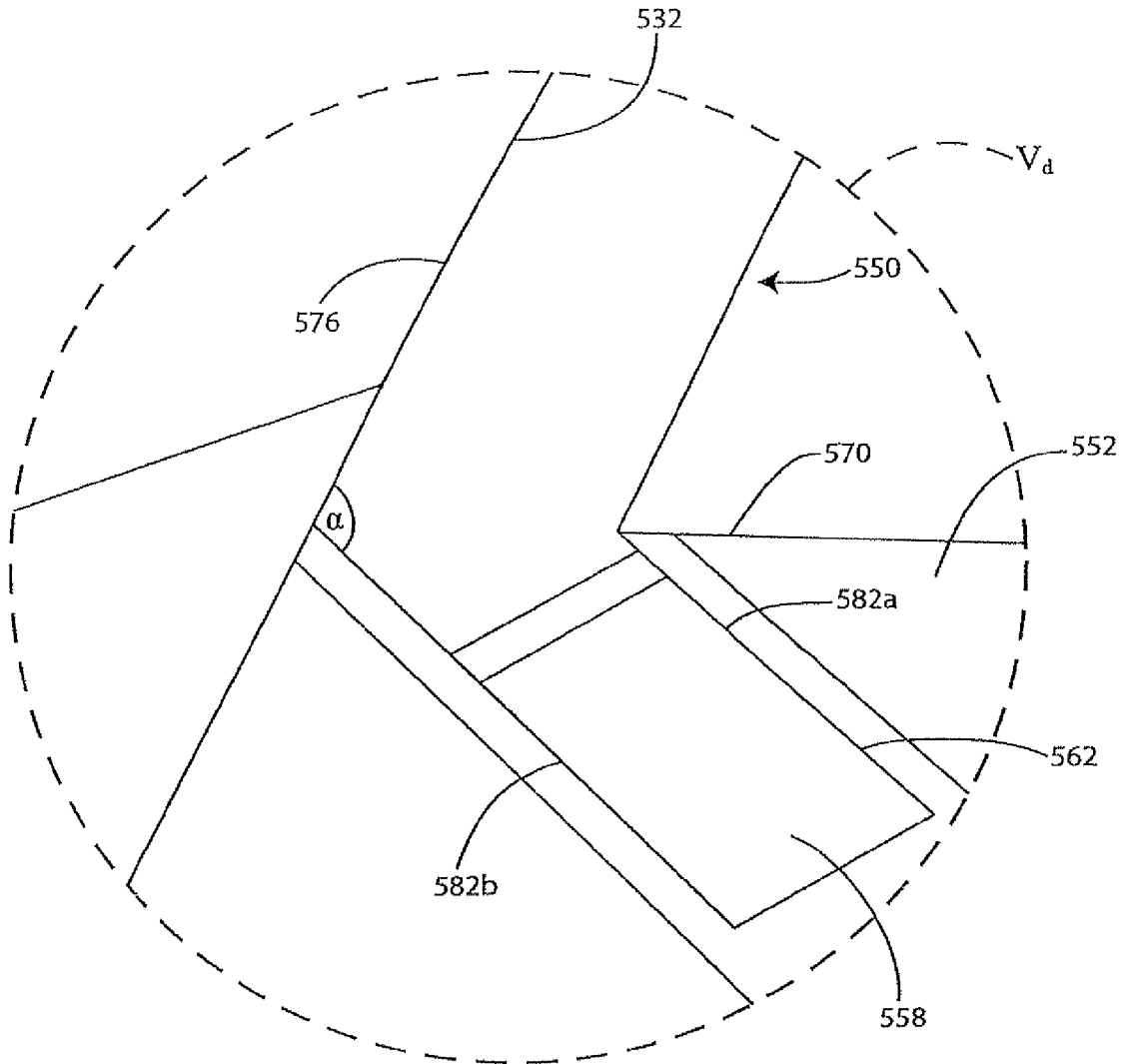


FIG. 5d

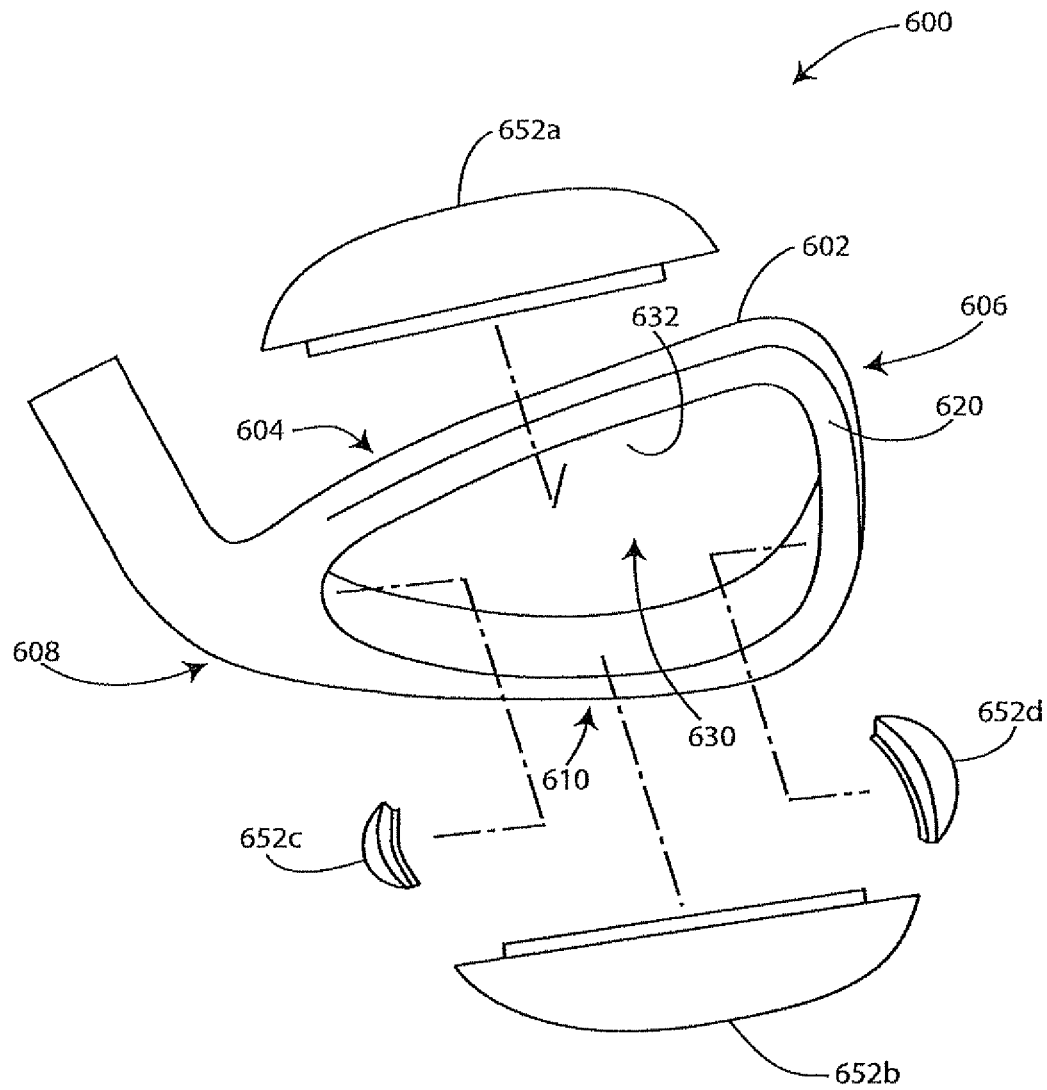


FIG. 6

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GOLF CLUB HEAD

This is a Continuation of application Ser. No. 13/158,197 filed Jun. 10, 2011, which is a Continuation of application Ser. No. 12/344,003 filed Dec. 24, 2008 (now U.S. Pat. No. 8,057, 322 B2 issued Nov. 15, 2011). The prior applications, including the specifications, drawings and abstracts are incorporated herein by reference in their entirety.

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BACKGROUND

Iron-type golf club heads may generally be classified into “blade” and “perimeter-weighted” categories. Perimeter-weighted iron-type club heads may have a substantial concentration of mass distributed behind the striking face in the form of at least one peripheral wall, sometimes called the perimeter-weighting element. A perimeter-weighted iron-type golf club head may also be referred to as a “cavity-back” iron head, or simply a “cavity-back”, because the perimeter-weighting element generally delimits a cavity in the rear portion of the club head opposite the striking face.

SUMMARY

An important performance aspect of cavity-back irons is the tactile feedback communicated to the player at ball impact. To reduce undesirable dynamic excitation synonymous with mishit shots, the perimeter-weighting element of a cavity-back club head may be provided with a complimentary vibration-damping member. A secure coupling of the vibration-damping member to the club head may require that features for retention of the vibration-damping member be integrally incorporated into the head. The added weight of these retention features may adversely affect the mass properties of the club head, negatively impacting performance. Moreover, potentially complex geometries of the retention features may increase manufacturing complexity and cost.

The present invention, in one or more aspects thereof, may advantageously comprise a golf club head having enhanced tactile feedback, augmented performance, and improved structural integrity.

In one example, a golf club head, according to one or more aspects of the present invention, may include a strike face, a rear wall behind the strike face, and a perimeter-weighting element at least partially surrounding the rear wall. The club head may further include a preload spacer, associated with the rear wall, and a resilient component, having a recess. The resilient component may be associated with the perimeter-weighting element. A portion of the preload spacer may be disposed in the recess of the resilient component, whereby the preload spacer biases the resilient component against a portion of the perimeter-weighting element.

In another example, a golf club head, according to one or more aspects of the present invention, may include a strike face, a rear wall behind the strike face, and a perimeter-weighting element at least partially surrounding the rear wall. The club head may further include a preload spacer associated with the rear wall and a resilient component, associated

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with the perimeter-weighting element. The resilient component may include a projection for engaging a portion of the preload spacer.

These and other features and advantages of the golf club head according to the invention in its various aspects, as provided by one or more of the examples described in detail below, will become apparent after consideration of the ensuing description, the accompanying drawings, and the appended claims. The accompanying drawings are for illustrative purposes only and are not intended to limit the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1a is a front perspective view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 1b is a front perspective view of the golf club head of FIG. 1a.

FIG. 1c is an exploded view of the golf club head of FIG. 1a.

FIG. 1d is a rear perspective view of the golf club head of FIG. 1a.

FIG. 1e is a cross-sectional view taken along the lines I_e-I_e of FIG. 1d.

FIG. 1f is an enlarged cross-sectional view of a detail I_f of FIG. 1e.

FIG. 1g is an enlarged cross-sectional view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 2a is an exploded view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 2b is a rear perspective view of the golf club head of FIG. 2a.

FIG. 2c is a cross-sectional view taken along the lines II_c-II_c of FIG. 2b.

FIG. 2d is an enlarged cross-sectional view of a detail II_d of FIG. 2c.

FIG. 3a is an exploded view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 3b is a rear perspective view of the golf club head of FIG. 3a.

FIG. 3c is a cross-sectional view taken along the lines III_c-III_c of FIG. 3b.

FIG. 3d is an enlarged cross-sectional view of a detail III_d of FIG. 3c.

FIG. 4a is an exploded view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 4b is a rear perspective view of the golf club head of FIG. 4a.

FIG. 4c is a cross-sectional view taken along the lines IV_c-IV_c of FIG. 4b.

FIG. 4d is an enlarged cross-sectional view of a detail IV_d of FIG. 4c.

FIG. 5a is an exploded view of an exemplary golf club head according to one or more aspects of the present invention.

FIG. 5b is a rear perspective view of the golf club head of FIG. 5a.

FIG. 5c is a cross-sectional view taken along the lines V_c-V_c of FIG. 5b.

FIG. 5d is an enlarged cross-sectional view of a detail V_d of FIG. 5c.

FIG. 6 is an exploded view of an exemplary golf club head according to one or more aspects of the present invention.

DETAILED DESCRIPTION

Referring to FIGS. 1a and 1b, a golf club head 100, according to one or more aspects of the present invention, may

generally comprise a strike face **102** and a body **103** having a top line **104**, a toe **106**, a heel **108**, and a bottom portion **110**. The strike face **102** may be integral with the body **103**, or joined thereto, e.g., by mechanical interlocking, welding, brazing, or adhesive bonding. A hosel **112** may extend from the body **103** to receive a shaft (not shown). As illustrated in FIG. 1c, the club head **100** may further include a main cavity **130**, which is delimited by a rear wall **132** surrounded, at least in part, by a perimeter-weighting element **140** that includes a rear surface **120**. The rear wall **132** is located behind the strike face **102**. Suitable materials for fabricating the golf club head **100** may include, e.g., carbon steel, stainless steel, 6-4 titanium alloy, 10-2-3 Beta-C titanium alloy, 6-22-22 titanium alloy, or the like.

As shown in FIGS. 1c and 1d, a resilient component **152** may be associated with the perimeter-weighting element **140**, e.g., to reduce undesirable vibration, correlated with mishit shots. The resilient component **152** may be made, e.g., from a material having a Shore hardness less than about 100 A, preferably less than about 90 A, and more preferably less than about 80 A. In one or more aspects of the present invention, the compliance of the resilient component may be tactilely perceptible, thus suggesting to the player that the golf club possesses beneficial dynamic-excitation response characteristics at ball impact and, accordingly, promoting increased player confidence in the equipment.

Examples of the materials suitable for fabricating the resilient component **152** may include polyurethane, silicone, Acrylonitrile Butadiene Styrene (ABS), Nylon, polycarbonate (PC), polypropylene (PP), polyethylene (PE), thermoplastic rubber (TPR), thermoplastic vulcanizate (TPV), thermoplastic elastomers (TPE), and natural rubber. In another example, the resilient component **152** may be made from thermoplastic polyurethane (TPU), having a Shore hardness between about 65 A and about 75 A. The specific gravity of the resilient component may depend on the material selected and may generally be between about 0.8 and about 2.0. Alternatively, the resilient component **152** may be densified by blending an elastic material with a higher-density substance, e.g., powdered tungsten. The specific gravity of the densified insert may be in a range from about 0.8 to about 15. Accordingly, the resilient component may be used to alter the weight distribution of the club head.

Referring again to FIG. 1c and to FIG. 1e, which shows the club head **100** along a front-to-back direction, the resilient component **152** may include a top surface **170**, a bottom surface **168**, a back surface **180** (FIG. 1e), and a front surface **172**. The bottom surface **168** may be bonded to the perimeter-weighting element **140** by using, e.g., an epoxy-type adhesive. Additionally, the back surface **180** may be at least partially adhesively coupled to the rear wall **132** of the club head **100**. The top surface **170** of the resilient component **152** may include a projection **154** (FIGS. 1c, 1e, and 1f).

FIGS. 1e-1g illustrate a preload spacer **150**, contiguous with the rear wall **132** of the club head. As shown in FIGS. 1e and 1f, the preload spacer **150** may include an anterior surface **174** and a posterior surface **176** that is bonded to the rear wall **132** by, e.g., an epoxy-type adhesive. To provide positive reinforcement of the adhesive coupling between the resilient component **152** and the club head **100**, a portion of the preload spacer **150**, e.g., a flange **158**, may engage the projection **154** of the resilient component **152**, such that at least a part of the resilient component **152** is compressed between the preload spacer **150** and the perimeter-weighting element **140**. The compression fit of the resilient component between the spacer **150** and at least a portion of the perimeter-weighting element promotes improved damping characteristics of the

club head. In another example of the present invention, illustrated in FIG. 1g, an adhesive layer **155** may be applied to only a portion of the posterior surface **176**. The segment of the preload spacer **150** that is dissociated from by the adhesive **155** may engage the projection **154** of the resilient component **152**.

Preferably, the preload spacer **150** is at least partially formed from a rigid metallic and/or non-metallic material, e.g., aluminum, titanium, ABS, fiber reinforced plastic, or poly-vinyl chloride (PVC). In one example, the preload spacer **150** may be a constrained-layer damper includes at least one constraining member, e.g., a rigid aluminum-alloy plate, and a visco-elastic layer, e.g., 3M™ VHB™ Adhesive Transfer Tape 9469.

In another example, illustrated in FIGS. 2a and 2c, a golf club head **200**, according to one or more aspects of the present invention, may generally include a strike face **202**, a top line **204**, a bottom portion **210**, a heel **208**, a toe **206**, and a hosel **212** for receiving a shaft (not shown). The club head **200** may further include a main cavity **230**, which is delimited by a rear wall **232** surrounded, at least in part, by a perimeter-weighting element **240** that includes a rear surface **220**. A resilient component **252** may be associated with the perimeter-weighting element **240**, e.g., to improve the dynamic-excitation response of the club head **200**. The resilient component **252** may include a top surface **270**, a bottom surface **268**, a front surface **272**, and a back surface **280** (FIG. 2c). Preferably, the bottom surface **268** of the resilient component **252** is coupled to the perimeter-weighting element **240**, e.g., by adhesive bonding. In one example of the present invention, the top surface **270** includes a recess **262** (FIGS. 2c and 2d).

Referring to FIGS. 2a-2d, a preload spacer **250** may be disposed in the main cavity **230**. The preload spacer **250** may include an anterior surface **274** and a posterior surface **276** that is coupled to the rear wall **232**, e.g., by an adhesive bond. As shown in FIGS. 2c and 2d, a portion of the preload spacer **250**, e.g., a flange **258**, may be disposed in the recess **262**, whereby the preload spacer **250** biases the resilient component **252** against a portion of the perimeter-weighting element **240** to provide positive reinforcement of the adhesive coupling between the resilient component and the club head **200**.

In another example, shown in FIGS. 3a-3d, a golf club head **300**, according to one or more aspects of the present invention, may generally include a strike face **302**, a top line **304**, a bottom portion **310**, a heel **308**, a toe **306**, and a hosel **312** for receiving a shaft (not shown). The club head **300** may further include a main cavity **330**, which is delimited by a rear wall **332** surrounded, at least in part, by a perimeter-weighting element **340** that includes a rear surface **320**. A resilient component **352** may be associated with the perimeter-weighting element **340**, e.g., to improve the dynamic-excitation response of the club head **300**. The resilient component **352** may include a top surface **370**, a bottom surface **368**, a front surface **372**, and a back surface **380** (FIG. 3c). Preferably, the bottom surface **368** of the resilient component **352** is coupled to the perimeter-weighting element **340**, e.g., by adhesive bonding. In one example of the present invention, the back surface **380** includes a recess **362** (FIGS. 3c and 3d).

Referring to FIGS. 3b and 3c, a preload spacer **350** may be disposed in the main cavity **330**. The preload spacer **350** may include an anterior surface **374** and a posterior surface **376** that is coupled to the rear wall **332**, e.g., by an adhesive bond. The back surface **380** of the resilient component **352** may preferably be contiguous with a portion of the anterior surface **374** and spaced or dissociated from the rear wall **332**. As shown in FIGS. 3c and 3d, the preload spacer **350** may include a flange **358** that extends from the anterior surface

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374 and interlocks with the recess 362 to provide positive reinforcement of the adhesive coupling between the resilient component 352 and the club head 300.

With reference to FIGS. 4a-4d, a golf club head 400, according to one or more aspects of the present invention, may generally include a strike face 402, a top line 404, a bottom portion 410, a heel 408, a toe 406, and a hosel 412 for receiving a shaft (not shown). The club head 400 may further include a main cavity 430, which is delimited by a rear wall 432 surrounded, at least in part, by a perimeter-weighting element 440 that includes a rear surface 420. A resilient component 452 may be associated with the perimeter-weighting element 440, e.g., to improve the dynamic-excitation response of the club head 400. The resilient component 452 may include a top surface 470, a bottom surface 468, a front surface 472, and a back surface 480 (FIG. 4c). Preferably, the bottom surface 468 of the resilient component 452 is coupled to the perimeter-weighting element 440, e.g., by adhesive bonding. In one example of the present invention, the top surface 470 includes a recess 462 (FIGS. 4c and 4d).

Referring to FIGS. 4b and 4c, a preload spacer 450 may be disposed in the main cavity 430. The preload spacer 450 may include an anterior surface 474 and a posterior surface 476 that is coupled to the rear wall 432, e.g., by an adhesive bond. The preload spacer 450 may further include a generally L-shaped flange 458, having a protruding portion 464 and a retaining portion 466. As shown in FIGS. 4c and 4d, the protruding portion 464 may be contiguous with a portion of the top surface 470, and the retaining portion 466 may be at least partially disposed in the recess 462. The preload spacer 450 biases the resilient component 452 against a portion of the perimeter-weighting element 440 to provide positive reinforcement of the adhesive coupling between the resilient component and the club head 400.

With reference to FIGS. 5a-5d, a golf club head 500, according to one or more aspects of the present invention, may generally include a strike face 502, a top line 504, a bottom portion 510, a heel 508, a toe 506, and a hosel 512 for receiving a shaft (not shown). The club head 500 may further include a main cavity 530, which is delimited by a rear wall 532 surrounded, at least in part, by a perimeter-weighting element 540 that includes a rear surface 520. A resilient component 552 may be associated with the perimeter-weighting element 540, e.g., to improve the dynamic-excitation response of the club head 500. The resilient component 552 may include a top surface 570, a bottom surface 568, a front surface 572, and a back surface 580 (FIG. 5c). Preferably, the bottom surface 568 of the resilient component 552 is coupled to the perimeter-weighting element 540, e.g., by adhesive bonding. In one example of the present invention, the top surface 570 includes an oblique recess 562 (FIGS. 5c and 5d). As shown in FIG. 5d, the recess 562 may include two walls 582a and 582b, oriented, e.g., at an angle α , e.g., between about 90° and about 170°, relative to the rear wall 532.

Referring to FIGS. 5b and 5c, a preload spacer 550 may be disposed in the main cavity 530. The preload spacer 550 may include a substantially planar anterior surface 574 and a posterior surface 576, coupled to the rear wall 532, e.g., by adhesive bonding. As shown in FIG. 5d, a portion of the preload spacer 550, e.g., a flange 558, engages the recess 562, whereby the preload spacer 550 biases the resilient component 552 against a portion of the perimeter-weighting element 540 to provide positive reinforcement of the adhesive coupling between the resilient component and the club head 500. Preferably, the flange 558 is oriented at an angle α between about 90° and about 170° relative to the rear wall 532. More

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preferably, the flange may be oriented at an angle α between about 100° and about 150° relative to the rear wall 532.

As illustrated in FIG. 6, a golf club head 600, according to one or more aspects of the present invention, may generally include a strike face 602, a top line 604, a bottom portion 610, a heel 608, and a toe 606. The club head 600 may further include a main cavity 630, which is delimited by a rear wall 632 surrounded, at least in part, by a perimeter-weighting element 640 that includes a rear surface 620. At least one resilient component, e.g., resilient components 652 a-d, may be associated with the perimeter-weighting element 640 proximate at least one of the top line 604, the bottom portion 610, the heel 608, and the toe 606. A preload spacer (not shown), similar to, e.g., the preload spacer 150, described above, may be disposed in the main cavity 630 and may interlock with the at least one resilient component to provide positive reinforcement of the coupling between the club head and the at least one resilient component.

In the foregoing specification, the invention has been described with reference to specific exemplary aspects thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention as set forth in the appended claims. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

The invention claimed is:

1. An iron-type golf head comprising:

a striking face;

a rear surface opposite the striking face;

a perimeter weighting element surrounding the rear surface and defining a cavity;

a one-piece metallic insert positioned at least partially in the cavity and having a complementary portion; and

a one-piece resilient component positioned at least partially in the cavity, the resilient component having a back surface at least partially adhesively coupled to the rear surface, the resilient component further having a projection that engages the complementary portion of the insert,

wherein the resilient component further includes a bottom surface that contacts the perimeter weighting element.

2. The iron-type golf head of claim 1, wherein a front-to-back width of the bottom surface is greater than a front-to-back width of the projection.

3. The iron-type golf head of claim 1, wherein the metallic insert comprises aluminum.

4. The iron-type golf head of claim 1, wherein the resilient component has a Shore hardness of less than 100 A.

5. The iron-type golf head of claim 1, wherein the resilient component has a Shore hardness of less than 90 A.

6. The iron-type golf head of claim 1, wherein the resilient component has a Shore hardness of less than 80 A.

7. The iron-type golf head of claim 1, wherein the adhesive coupling of the resilient component to the rear surface is accomplished by an adhesive layer.

8. The iron-type golf head of claim 7, wherein the adhesive layer comprises a visco-elastic.

9. An iron-type golf head comprising:

a striking face;

a rear surface opposite the striking face;

a perimeter weighting element surrounding the rear surface and defining a cavity;

a unitary metallic insert positioned at least partially in the cavity and having an engagement portion; and

a unitary resilient component compression fitted at least partially in the cavity, the resilient component having a

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back surface at least partially adhesively coupled to the rear surface, the resilient component further having a projection configured to engage the engagement portion of the insert to interlock the resilient component with the metallic insert.

10. The iron-type golf head of claim 9, wherein the resilient component further includes a bottom surface that contacts the perimeter weighting element.

11. The iron-type golf head of claim 10, wherein a front-to-back width of the bottom surface is greater than a front-to-back width of the projection.

12. The iron-type golf head of claim 9, wherein the metallic insert comprises aluminum.

13. The iron-type golf head of claim 9, wherein the resilient component has a Shore hardness of less than 100 A.

14. The iron-type golf head of claim 9, wherein the resilient component has a Shore hardness of less than 90 A.

15. The iron-type golf head of claim 9, wherein the resilient component has a Shore hardness of less than 80 A.

16. The iron-type golf head of claim 9, wherein the adhesive coupling of the resilient component to the rear surface is accomplished by an adhesive layer.

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17. The iron-type golf head of claim 16, wherein the adhesive layer comprises a visco-elastic.

18. A golf head comprising:

a striking face;

a rear surface opposite the striking face;

a perimeter weighting element surrounding the rear surface and defining a cavity;

a one-piece metallic insert positioned at least partially in the cavity and having a complementary portion; and

a one-piece resilient component positioned at least partially in the cavity, the resilient component having a back wall at least partially adhesively coupled to the rear surface and a bottom surface that contacts the perimeter weighting element, the resilient component further having a projection engaging the complementary portion of the insert,

wherein a front-to-back width of the bottom surface is greater than a front-to-back width of the projection.

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